ENERGOPTIONS

OVERVIEW PAPER

COMMERCIAL SECTOR

Broad Application

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1. INTRODUCTION

Energy charges for commercial buildings in Canada are a significant component of space costs. Space conditioning requirements represent the main energy load in buildings. Computerized energy management systems that can yield payback periods in the order of 1 year and innovative approaches such as ground-source heat pumps can significantly reduce these costs.

These and other projects are successful demonstrations of energy saving technologies. Collectively, the projects illustrate a wide variety of opportunities for commercial application.

This paper provides an overview of a number of proven measures together with documentation of important lessons learned. Suggestions on appropriate next steps and details on resources available are also presented.

2. OPTIONS

With support from the Federal/Provincial Conservation and Renewable Energy Demonstration Agreements (CREDA) Program, a range of attractive options were demonstrated. These options include:

- **Lower Cost Measures**

  - Caulk, seal and weatherstrip (air seal) to reduce heat loss associated with infiltration of unconditioned outside air.

  - Utilize night setback thermostats and auto exhaust "turn off" when the building is not in use.

  - Remove unnecessary lighting and clean light fixtures on a regular basis.

- Keep the Heating, Ventilating and Air Conditioning (HVAC) system in top running order including regular cleaning of all air filters.

- Insulate hot water or steam pipe systems

. **Computerized Energy Monitoring and Management**

- Use a centrally located computer to monitor and control energy consumption in one or more buildings.

. **HVAC Alternatives**

- Consider using a small fire-tube boiler as an economizer/heat recovery unit in winter. In summer, this small boiler can efficiently supply the building's reduced energy requirements.

- Consider heat pumps, including ground and groundwater source units, or wood heating for new buildings and for buildings where the existing heating system must be replaced.

. **Building Shell Retrofit**

- Increase building shell insulation levels in conjunction with building renovation programs.

3. CREDA DEMONSTRATIONS

The CREDA projects outlined below provide a sample of a number of options for reducing energy consumption and costs in the commercial sector. They not only provide tangible evidence of significant energy cost savings that can be realized in commercial buildings, but also provide practical installation and operation experience.

Demonstration project Case Studies contained in this ENEROPTIONS package are:

ONT 54 Computerized Energy Accounting - Ontario

Hudson's Bay Company uses a microcomputer program to monitor monthly energy use in 65 buildings in southern Ontario and to pinpoint inefficient systems and areas of waste. Detailed computer-assisted audits of three buildings identified potential energy savings of over $1 million per year. Hudson's Bay found that the better information and increased management effectiveness alone justified the system.

BC 22 Building Energy Management System - Surrey, British Columbia

Energy use in several buildings is monitored and controlled by one central computer which is linked to the individual buildings by way of leased telephone lines. Payback periods as rapid as 1.3 years have been attained.

ONT 45 Low Temperature Flue Gas Heat Recovery System - Welland, Ontario

John Deere Ltd. installed a Beckett Heat Recovery System which saved the company over $35,000 annually. In the winter, a standard fire-tube boiler is used as an economizer with flue gas being cooled to slightly above the dew point. In summer, or during the "off season", the same unit serves as a compact, economical steam source for the plant's reduced requirements. Similar units are installed in the Welland Hospital and at Carleton University in Ottawa.

ONT 60 Vertical Loop Ground-Source Heat Pump - Toronto, Ontario

Existing oil-fired boilers in an industrial shop facility were replaced with glycol-to-water heat pumps which extract heat from the ground using a series of vertically buried loops.

ONT 29 Exterior Insulation Retrofit - Kingston, Ontario

A sixteen-storey residence building, the John Orr Tower, at Queen's University, was retrofitted on the exterior with 3 inches of extruded polystyrene insulation and covered by steel cladding in order to reduce heat loss and rectify a water penetration problem. Annual energy savings were about 28%.

NB 54 Wood Residue Fuelled Boiler - University of New Brunswick - Fredericton, New Brunswick

A large wood-fired boiler was installed, under an innovative financing arrangement, at the district heating plant which serves the entire UNB-Fredericton campus, two apartment buildings, and a large 485-bed hospital. Annual operating savings in the range of $820,000 are being realized as the contribution to total heating requirements is over 70%.

YUK 17 Pelly Crossing Wood-Chip Furnace Project - Pelly Crossing, Yukon

Space heating and domestic hot water for the community's new 1,300 m^2 school is provided by an automatic-feed, wood-chip boiler. Fuelwood for the boiler is harvested locally. Savngs appear to be $11,425, or 60% of the cost of operating a conventional, oil-fired system.

Many other projects applicable to the commercial sector have been undertaken across the country. Contact a government energy office listed on the file folder to learn more.

4. LESSONS LEARNED

Low-Cost Measures and General Lessons. Many low-cost measures can be implemented by operational staff and local contractors without extensive studies. Experience shows that such measures are often cost-effective and funding can generally come from existing operating budgets. Because every energy facility is unique, the services of a qualified, in-house energy auditor or experienced engineering consultant are required to identify an appropriate program of higher cost measures.

The understanding and commitment of building operational staff is an important key to success. Not only are staff suggestions, based on familiarity with the facility, valuable, but staff commitment to the measures eventually installed is often critical. These people can usually offer excellent suggestions on low-cost measures and should be encouraged to work closely with an energy auditor later in the program when higher cost measures are implemented. In sum, the dedication and cooperation of those operational staff responsible for keeping equipment in top running order is required to produce maximum savings.

Computerized Energy Monitoring and Management. Automated control systems are most cost effective (e.g., one year paybacks can be obtained) in buildings with heavy yet highly variable use patterns. Such systems are likely not cost-effective for buildings characterized by continuous and consistent use patterns.

Using a computer system to monitor energy consumption has proved to be a low-cost method of identifying areas of large potential savings before incurring the expense of on-site audits.

A comprehensive, functional specification prepared by qualified specialists is required for all systems. The statement of functional requirements should take precedence over a premature selection of specific hardware and software. The quality of this specification will have an important bearing on the success of the project. To operate successfully, all hardware, software and communication links must be compatible. By having one party take overall responsibility for the entire system, incompatibility problems can be avoided and areas of responsibility can be clearly defined.

Consider using a two-stage tendering process. In the first stage, potential suppliers are invited to submit unpriced technical proposals in response to the functional specification. These proposals can be reviewed, clarifications can be obtained and the functional specification can be refined to ensure that all bids are directly comparable on a functional basis. In the second stage, a smaller group of qualified bidders can be invited to submit refined price proposals based on the final specification. If a single stage bidding process is used, the technical quality of the proposals may differ widely and the low priced bid may not represent the best overall value.

The installation of a computer or microprocesor controlled system will provide an exciting challenge to some operation staff while others may view it as a threat or possibly as an adversary to be defeated. Skillful employee management is required to ensure that:

a) staff receive the required training,

b) more than one person can program, operate and maintain the system, and

c) suitable action is taken with staff members who are not adjusting to the new technology.

HVAC Systems. Maximum low grade heat recovery from boiler flue gas is attained by closely controlling the temperature of the flue gas so that it remains close to, but safely above, the dew point.

Heat pumps can often provide much higher efficiencies than other approaches. Their use and that of wood burning systems should be investigated for new buildings or in buildings where the existing heating system must be replaced.

Building Shell Retrofit. Each building must be treated as an integrated system. If a significant sealing or insulating program is undertaken, modifications to the HVAC system will also likely be necessary to ensure indoor air quality and comfort.

The application of exterior insulation to an existing building is usually cost-effective only when performed in conjunction with an architectural retrofit of the building. This measure, like the installation of extra roof insulation, generally cannot be justified on the basis of energy savings alone.

When attaching exterior cladding insulation to an existing building, the use of metal channels, drilled holes and serrated nails was found to be less expensive than an approach based on the use of wooden strapping. Further development of the fastening system and improvement in contractor skills are required to bring down the cost of this approach.

5. NEXT STEPS

The demonstration case studies contained in this ENEROPTIONS package present some technologies which are applicable to the commercial sector. It is hoped that they will be useful to you by:

- indicating applications that may be relevant to you or your organization,
- presenting both actual benefits and actual problem areas that you can expect should you pursue a similar initiative.

To assist you, several "next steps" are suggested below:

- Obtain free copies of final reports on projects that are of interest from addresses listed at the end of the case studies.
- Contact the appropriate demonstration project manager and/or equipment supplier listed in the case study to obtain further information.
- Establish administration responsibility for energy consumption and costs in your buildings.
- Undertaken an energy audit to identify the appropriate package of measures for your buildings.
- If you lack the necessary in-house engineering resources to identify and implement the appropriate package of measures, you should consider retaining the services of a qualified engineering consultant.

6. RESOURCES AVAILABLE

Free technical reports are available for most of the CREDA projects listed above. Addresses of appropriate contacts for follow-up, including equipment suppliers and system designers, are listed at the end of each of the attached ENEROPTIONS Case Studies under the "Further Information" section.

The departments or ministries of energy in each province or territory have information on energy conservation and alternative energy and may have assistance programs. Check your telephone directory for appropriate contact people.

The Conservation and Renewable Energy Offices (CREOs) of Energy, Mines and Resources Canada in each province and territory have information on federal demonstrations, and other assistance programs. Check the back of the attached file folder for the office in your area.

Information on qualified engineering firms and the "Recommended Procedure for the Selection of an Engineer to Provide Professional Services" can be obtained from:

a) The Association of Consulting Engineers of Canada
(Re: ENEROPTIONS)
Suite 616
130 Albert Street
Ottawa, Ontario
K1P 5G4
(613) 236-0569

b) The consulting engineering organization in each province.

Information on innovative financing arrangements can be obtained through the government departments listed above and/or by contacting:

Martin Adelaar
(Re: ENEROPTIONS)
Energy Management Advisor
Energy Conservation and Oil Substitution Branch
Energy, Mines and Resources Canada
580 Booth Street
Ottawa, Ontario
K1A 0E4
(613) 995-1118